

PATENT CLAIMS

1. Process for the production of nanoparticles, mixtures of nanoparticles, nanoscale solutions, as well as supersaturated solutions in general, especially also such multi element combination as well as multi-component-mineral substance and multi-component trace element preparations, as characterized by the following steps:

a) the presence of a mineral or trace element containing suspension, which contains:

i) at least 1 alkaline earth or alkali element in a concentration range which contains between 1,0 and 50 weight %, preferably between 2,0 and 25 weight%, which is at least up to 50 weight% present in a mineral and/or ionically not easily soluble form and

ii) at least 1 element from the

- A Group of the elements, comprising silicon, iron, aluminum, manganese, chrome, boron, titanium, nickel, copper, zinc, vanadium, molybdenum and cobalt, or from the

- B Group of the elements, comprising selenium, zircon, rubidium, lithium, yttrium, cerium, palladium, lanthanum, neodymium, silver, wolfram, gallium, tellurium, thorium, praseodymium, niobium, samarium, gadolinium, dysprosium, arsenic, scandium, indium, antimony, cesium, germanium and ytterbium, or from the

- C Group of the elements comprising erbium, europium, bismuth, platinum, tantalum, terbium, holmium, rubidium, beryllium, gold and rhodium

iii) in a molar ratio referred to the sum of the alkali and alkaline earth elements between 0,1% and 30%, preferably between 0, 3% and 10%, and

5 b) the introduction of particle dismembering or dispersing energy in the suspension by retention of a dispersed concentrate and

10 c) mixing of the dispersed concentrate with acid.

2. Process according to claim 1, **characterized in that** at least 2 alkaline earth elements are contained in a concentration range contain between 1,0 and 50 weight %, preferably between 3,0 and 35 weight.%.

3. Process according to the aforementioned claims, **characterized in that** at least one alkaline earth component is present as oxide and/or hydroxide and/or carbonate and/or hydrogen carbonate.

4. Process according to one of the aforementioned claims, **characterized in that** the suspension contains at least 4 elements from the A Group of the elements, in a molar ratio, each referred to the sum of the alkali and alkaline earth elements between 0,1% and 30%, preferably between 0, 3% and 10%.

5. Process according to one of the aforementioned claims, **characterized in that** the suspension contains at least 4 elements from the B Group of the elements in a molar ratio,

each referred to the sum of the elements from the A Group, between 0,05% and 30%, preferably between 0,1% and 5%.

6. Process according to one of the aforementioned claims, **characterized in that** the suspension contains at least 4 elements from the C Group of the elements in a molar ratio, each referred to the sum of the elements from the B Group, between 0,05% and 30%, preferably between 0,1% and 5%.

7. Process according to at least one of the aforementioned claims, **characterized in that** the mineral substance matrix substantially consists of ash of plant and/or animal origin .

8. Process according to at least one of the aforementioned claims, **characterized in that** the ash is produced in a thermally-oxidizing manner and/or by a plasma process and/or by reaction of organic raw substances with activated oxygen species.

9. Process according to at least one of the aforementioned claims, **characterized in that** as raw material wood, nut shells, fruit stones, fruit skins, in particular orange peel, lemon peel, potato skins, olive stones, pine cones, roots, wheat husks, rice husks, as well as mixtures, extracts or press cakes of those are used.

10. Process according to at least one of the aforementioned claims, **characterized in that** plant press cakes and/or extraction residues, in particular of sunflower seeds, nuts, thistle, rape seed, sesame, rosehip, olives, poppy, apricot stones, pumpkin seeds, oranges, lemons, potato skins, roots,

wheat brans, rice husks, aloe vera and ginseng are used as resultant products.

11. Process according to at least one of the aforementioned
5 claims, **characterized in that** components or minerals from the group of the iodine, bromine, fluoride salts and selenium combinations are added to the ash.

12. Process according to at least one of the aforementioned
10 claims, **characterized in that** the suspension is ground or dispersed at a pH > 7 , preferably > 10 and especially preferably > 11.

13. Process according to at least one of the aforementioned
15 claims, **characterized in that oxidizing** species such as hydrogen peroxide, ozone, singlet oxygen or atomic oxygen are added to the suspension.

14. Process according to at least one of the aforementioned
20 claims, **characterized in that** of the distributing or dispersion process is carried out with the help of a ball mill, bead mill, colloidal mill, centrifugal mill or with a high pressure jet.

15. Process according to at least one of the aforementioned
25 claims, **characterized in that** in the dispersion process energies are introduced, referred to the tonne solids between 100 and 100.000 kwh, preferably between 500 and 5.000 kwh.

16. Process according to at least one of the aforementioned
30 claims, **characterized in that** of the medium diameter of the primary grinding bodies lies between 0.05 and 2 mm.

17. Process according to at least one of the aforementioned claims, **characterized in that** the ground up suspension is classified by means of at least one centrifuge or at least of one membrane or at least one sieve.

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18. Process according to at least one of the aforementioned claims, **characterized in that** the acid is added in the form of one or several foodstuff materials comprising citric acid, malic acid and other fruit acids, as well as ascorbic acid,
10 lactic acid, fruit juices, phosphorous acid, saline acid as well as mixtures of the same.

19. Process according to at least one of the aforementioned claims, **characterized in that** the disperse concentrate is
15 temporarily stored and is not mixed with the acid until shortly or immediately before use.

20. Process according to at least one of the aforementioned claims, **characterized in that** bio-organisms are added to the
20 solution for stabilisation

21. Process according to at least one of the aforementioned claims, **characterized in that** as bio-organisms stabilizing the nanoparticles bacteria such as lactic acid bacteria, kombucha,
25 effective micro-organisms, yoghurt bacteria, yeasts, fungus are used.

22. Process according to at least one of the aforementioned claims, **characterized in that** the suspension containing
30 nanoparticles is stabilized chemically by the addition of

coordinating / absorbing substances like e.g. gelatin, agar, xanthan, carob seed powder, pectin, vegetable juices.

23. Process for the production of an easily pulverizable dry substance of a nanoscale or supersaturated solution of mineral substances and trace elements corresponding to claims 1 to 22, **characterized in that** the nanoscale solution is converted with the help of a suitable drying process, preferably by spray freeze drying.

24. Process according to the aforementioned claim, **characterized in that** the dry substance easily dispersable at nanoscale is processed into a granulate or into tablets and/or capsules.

25. Process according to at least one of the aforementioned claims, **characterized in that** the easily dispersable dry substance is mixed with crystalline acid, for example citric acid and/or malic acid, and is optionally be processed into tablets, granulate or into capsules.

26. A device for the production or for the activation of mineral substance preparations corresponding to the process claims 1 to 22, **characterized in that** this contains at least two segments locally being separated by a seal, whereby one segment contains substantially disperse concentrate and the second segment contains acid, and whereby the seal may be opened by definite pressure on at least one of the two segments, whereby the contents of both segments come into contact with each other.

27. Nanoscale and/or supersaturated solutions of mineral substance or trace elements, produceable according to claims 1 to 24, **characterized in that**

- 5 a) these contain at least 1 chemical element comprising from the
- A-Group of the elements, again comprising silicon, iron, aluminum, manganese, chrome, boron, titanium, nickel, copper, zinc, vanadium, molybdenum and cobalt, or from the
 - 10 - B-Group of the elements, again comprising selenium, zircon, rubidium, lithium, yttrium, cerium, palladium, lanthan, neodymium, silver, wolfram, gallium, tellurium, thorium, praseodym, niobium, samarium, gadolinium, dysprosium, arsenic, scandium, indium,
 - 15 antimony, cesium, germanium and ytterbium, or from the
 - C Group of the elements again comprising erbium, europium, bismuth, platinum, tantalum, terbium, holmium, rubidium, beryllium, gold
 - which

- 20 i) forms one or several crystals or agglomerates or amorphous structures, or is embedded into such,
- ii) which in a respective solution at room temperature within one hour have a growth in size in particle diameter between
- 25 0,1nm and 10 μ m,

b) whereby this at least 1 chemical element is embedded to a maximum of 20 weight % in particles greater than 100 nm.

- 30 28. Nanoscale and/or supersaturated solutions of mineral substances or trace elements, according to the aforementioned claim, **characterized in that**

a) these contain at least 2 chemical elements, comprising from the

- A Group of the elements and/ or from the
- B Group of the elements and/ or from the

5 - C Group of the elements,

i) whereby these form crystals, agglomerates or amorphous structures or are embedded into such,

10 ii) which in a respective solution at room temperature within one hour have a growth in particle diameter between 0,1nm and 10 µm, and

b) these at least 2 chemical elements are embedded to a maximum of 20 weight % in particles greater than 100 nm.

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29. Nanoscale and/or supersaturated solutions of mineral substances or trace elements, according to the aforementioned claim, **characterized in that**

20 a) these contain at least 4 chemical elements, comprising from the

- A Group of the elements and/ or from the
- B Group of the elements and/ or from the
- C Group of the elements

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i) whereby these form crystals, agglomerates or amorphous structures or are embedded into such,

30 ii) which in the respective solution at room temperature within one hour have a growth in particle diameter between 0,1nm and 10 µm, and

b) these at least 4 chemical elements are embedded to a maximum 20 weight % in particles greater than 100 nm.

- 5 30. Nanoscale and/or supersaturated solutions of mineral substances or trace elements, according to the aforementioned claim, **characterized in that**

a) these contain at least 6 chemical elements, comprising from
10 the

- A Group of the elements and/ or from the
- B Group of the elements and/ or from the
- C Group of the elements,

15 i) whereby these form crystals, agglomerates or amorphous structures or are embedded into such,

ii) which have in the respective solution at room temperature within one hour a growth in particle diameter between 0,1nm and 10 µm, and

20 b) these at least 6 chemical elements are embedded to maximum 20 weight.% in particles greater than 100 nm.

31. Nanoscale and/or supersaturated solutions of mineral
25 substances or trace elements, according to the aforementioned claim, **characterized in that**

a) these contain at least 8 chemical elements, comprising from the

- A Group of the elements and/ or from the
- 30 - B-Group of the elements and/ or from the
- C-Group of the elements

i) whereby these form crystals, agglomerates or amorphous structures or are embedded into such
ii) which have in respective solution at room temperature within one hour a growth in particle diameter between 0,1nm
5 and 10 μm , and

b) these at least 8 chemical elements are embedded to a maximum of 20 weight.% in particles greater 100 nm.

10 32. Nanoscale and/or supersaturated solutions of mineral substances or trace elements, according to at least one of the aforementioned claims, **characterized in that** the particle growth speed is between 1 nm and 1 μm per hour.

15 33. Nanoscale and/or supersaturated solutions of mineral substances or trace elements according to at least one of the aforementioned claims, **characterized in that** at least 2 of the at least 5 elements are present in the concentration range between 30 g/l and 10 mg/l, preferably between 15 g/l and 10
20 $\mu\text{g/l}$.

34. Nanoscale and/or supersaturated solutions of mineral substances or trace elements according to at least one of the aforementioned claims, **characterized in that** at least 4 of the
25 at least 8 elements are present in a concentration range between 30 g/l and 10 mg/l, preferably between 15 g/l and 10 $\mu\text{g/l}$.

35. Nanoscale and/or supersaturated solutions of mineral
30 substances or trace elements according to at least one of the aforementioned claims, **characterized in that** the at least 4 elements are present in a molar ratio with respect to each

other, each of which is not greater than 1.000, preferably not greater than 500.

36. Nanoscale and/or supersaturated solutions of mineral substances or trace according to at least one of the aforementioned claims, **characterized in that** at least 4 of the at least 8 elements are embedded to maximum 20 weight.% in particles greater 80 nm.

37. Nanoscale and/or supersaturated solutions of mineral substances or trace elements according to at least one of the aforementioned claims, **characterized in that** at least 4 of the at least 8 elements stem from the group comprising gold, silver, platinum, bismuth, copper, palladium, iron, wolfram.

38. Nanoscale and/or supersaturated solution of mineral substances or trace elements according to at least one of the aforementioned claims, **characterized in that** the metallic or metalloid or cationic species contained therein is substantially obtained from the incineration of plant or animal raw materials.

39. Nanoscale and/or supersaturated solution of mineral substances or trace elements according to at least one of the aforementioned claims, **characterized in that** at least 60% of all mineral species are smaller than 100 nm.

40. Nanoscale and/or supersaturated solution of mineral substances or trace elements according to at least one of the aforementioned claims, **characterized in that** at least 80% of all mineral species are smaller than 100 nm.

41. Use of the nanoscale and/or supersaturated solution of mineral substances or trace elements, produceable according to at least one of the previously mentioned claims, as food, food supplementary agents, cosmetics, pharmaceutical.

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42. Process for the production of nanoscale emulsions corresponding to claims 1 to 23, **characterized in that** the mineral substances of the disperse phase are introduced in supersaturated form into an oil.

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43. Process for the production of nanoscale emulsions corresponding to the aforementioned claim, **characterized in that** the mineral substance-rich solution is introduced into the oil phase by means of a rotor/stator system, a membrane process, an ultrasound process, a premix process or a high pressure-jet process at a jet speed of between 30 m/s and 500 m/s.

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